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Suzuki

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(54) **SWITCHING DC-TO-DC CONVERTER  
HAVING ON-TIME SIGNAL GENERATION  
CIRCUIT AND METHOD FOR GENERATING  
SIGNAL INDICATIVE OF CONVERTER  
ON-TIME**

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(58) Field of Search ..... 323/282, 283,  
323/288, 325, 326

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(57) **ABSTRACT**

An on-time signal generation circuit for use in a switching DC-to-DC converter, a switching DC-to-DC converter including such a circuit, and a method for generating an on-time signal which is a binary pulse train comprising pulses  $T_{ON}$ , where the width of each pulse  $T_{ON}$  is equal to  $T_{OSC}(V_{out}/V_{in})$ , where  $T_{OSC}$ ,  $V_{in}$ , and  $V_{out}$  are, respectively, the switching period and the input potential of a DC-to-DC converter, and a control potential. The control potential  $V_{out}$  is one of the output potential of the DC-to-DC converter and a DC potential proportional to a desired level of such output potential. The on-time signal generation circuit includes a comparator, a ramp generator with an output coupled to one input of the comparator, and an amplifier with an output coupled to the other input of the comparator. The ramp generator generates a periodic ramped potential having peak level  $kV_{in}$  and period  $T_{osc}$ . The amplifier receives the control potential  $V_{out}$  and is configured to assert an amplified potential  $kV_{out}$  in response thereto. In response to potential  $kV_{out}$  from the amplifier and ramped voltage  $kV_{in}$  from the ramp generator, the comparator asserts a pulse train comprising pulses  $T_{ON}$ . The width of each pulse  $T_{ON}$  is equal to  $T_{OSC}(V_{out}/V_{in})$ , and thus is indicative of the nominal or critical power switch on-time needed for the DC-to-DC converter to produce an output equal to  $V_{out}$  in response to input  $V_{in}$ . Preferably, the on-time signal generation circuit is implemented so that the width of each pulse  $T_{ON}$  is equal to  $T_{OSC}(V_{out}/V_{in})$  independently of process variations and variations in operating temperature.

24 Claims, 4 Drawing Sheets

